

# INTERNATIONAL SEARCH REPORT

application No

/GB2005/005058

**A. CLASSIFICATION OF SUBJECT MATTER**

C07D209/88 H01L51/30 C08G61/12 C08L65/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

C07D H01L C08G C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, CHEM ABS Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No.   |
|-----------|--|---|
| X         | <p>DATABASE WPI<br/>         Section Ch, Week 198632<br/>         Derwent Publications Ltd., London, GB;<br/>         Class A26, AN 1986-208862<br/>         XP002373618<br/>         &amp; JP 61 141725 A (AGENCY OF IND SCI &amp;<br/>         TECHNOLOGY) 28 June 1986 (1986-06-28)</p> <p>abstract</p> <p>-----</p> <p>-/-</p> | <p>1, 3-5, 7,<br/>         18, 24,<br/>         25, 29,<br/>         30, 33,<br/>         38, 39,<br/>         42,<br/>         45-49,<br/>         53, 55-58</p> |



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority, claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

|   |  |
|---|--|
| Date of the actual completion of the international search   | Date of mailing of the international search report |
| 22 March 2006   | 03/04/2006   |
| Name and mailing address of the ISA/<br>European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Authorized officer<br><br>Meiners, C               |

## INTERNATIONAL SEARCH REPORT

application No

GB2005/005058

## C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No.                                  |
|-----------|---|--|
| X         | HAMEURLAINE A ET AL: "Synthesis of soluble oligocarbazole derivatives" TETRAHEDRON LETTERS, ELSEVIER, AMSTERDAM, NL, vol. 44, no. 5, 27 January 2003 (2003-01-27), pages 957-959, XP004408875 ISSN: 0040-4039 the whole document -----                  | 1-7, 18,<br>24-26,<br>28-35,<br>38, 39,<br>42, 55, 57  |
| X         | JOVANOVIC M V ET AL: "Bromination of 10-phenylphenothiazine and 10-phenylphenoxazine" JOURNAL OF ORGANIC CHEMISTRY, AMERICAN CHEMICAL SOCIETY, EASTON, US, vol. 49, 1984, pages 1905-1908, XP002275206 ISSN: 0022-3263 the whole document -----         | 1, 3-5,<br>19,<br>24-26,<br>28, 54                     |
| X         | WO 03/074628 A (CDT OXFORD LIMITED; ANDREWS, MARK, DAVID; LOOK, KAI; MOSLEY, ALAN; STE) 12 September 2003 (2003-09-12) examples claims 1-10 -----   | 8-13, 18,<br>24-26, 28                                 |
| X         | HELLWINKE, D.; SCHMIDT, W.: "Zweifach ortho-verbrückte Triphenylamin-Derivate" CHEMISCHE BERICHTE, vol. 113, 1980, pages 358-384, XP009063905 page 358, line 1 - page 364, line 24 -----  | 14-26, 28  |
| X         | ZHANG, Q. ET AL.: "Novel hole-transporting materials based on 1,4-bis(carbazolyl)benzene for organic light-emitting devices" JOURNAL OF MATERIALS CHEMISTRY, vol. 14, no. 5, 20 January 2004 (2004-01-20), pages 895-900, XP002373568 schemes 1,2 ----- | 1, 3-5,<br>8-11, 13,<br>18, 24-26                      |
| X         | PATENT ABSTRACTS OF JAPAN vol. 2003, no. 11, 5 November 2003 (2003-11-05) -& JP 2003 212850 A (JAPAN SCIENCE & TECHNOLOGY CORP), 30 July 2003 (2003-07-30) abstract paragraph [0028]; claims 1,2; table 1 -----   | 1-6, 18,<br>24-26,<br>29, 33,<br>35, 38,<br>39, 42, 55 |

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## INTERNATIONAL SEARCH REPORT

application No  
'GB2005/005058

## C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
|-----------|--|-----------------------|
| P , X     | PATENT ABSTRACTS OF JAPAN<br>vol. 2003, no. 12,<br>5 December 2003 (2003-12-05)<br>& JP 2005 071909 A (DAINIPPON PRINTING CO LTD), 17 March 2005 (2005-03-17)<br>abstract<br>----- | 8-13,<br>28-56        |

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application No  
GB2005/005058

| Patent document cited in search report |   | Publication date |    | Patent family member(s) |  | Publication date |
|--|---|------------------|----|-------------------------|--|------------------|
| JP 61141725                            | A | 28-06-1986       | JP | 1660995 C               |  | 19-05-1992       |
|  |   |                  | JP | 3062175 B               |  | 25-09-1991       |
| WO 03074628                            | A | 12-09-2003       | AU | 2003210004 A1           |  | 16-09-2003       |
|  |   |                  | CN | 1643108 A               |  | 20-07-2005       |
|  |   |                  | EP | 1481036 A1              |  | 01-12-2004       |
|  |   |                  | JP | 2005519429 T            |  | 30-06-2005       |
| JP 2003212850                          | A | 30-07-2003       |    | NONE                    |  |                  |
| JP 2005071909                          | A | 17-03-2005       |    | NONE                    |  |                  |

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

REC'D 31 MAR 2006

PCT  
WIPO

PCT

## WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Applicant's or agent's file reference  
see form PCT/ISA/220

Date of mailing  
(day/month/year) see form PCT/ISA/210 (second sheet)

### FOR FURTHER ACTION

See paragraph 2 below

International application No.  
PCT/GB2005/005058

International filing date (day/month/year)  
23.12.2005

Priority date (day/month/year)  
29.12.2004

International Patent Classification (IPC) or both national classification and IPC  
C07D209/88, H01L51/30, C08G61/12, C08L65/00

Applicant  
CAMBRIDGE DISPLAY TECHNOLOGY LIMITED

**1. This opinion contains indications relating to the following items:**

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

**2. FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

**3. For further details, see notes to Form PCT/ISA/220.**

Name and mailing address of the ISA:



European Patent Office  
D-80298 Munich  
Tel. +49 89 2399 - 0 Tx: 523656 epmu d  
Fax: +49 89 2399 - 4465

Authorized Officer

Meiners, C

Telephone No. +49 89 2399-6056



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**Box No. I Basis of the opinion**

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1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.  
 This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material:  
 a sequence listing  
 table(s) related to the sequence listing
  - b. format of material:  
 in written format  
 in computer readable form
  - c. time of filing/furnishing:  
 contained in the international application as filed.  
 filed together with the international application in computer readable form.  
 furnished subsequently to this Authority for the purposes of search.
3.  In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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**Box No. II Priority**

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1.  The validity of the priority claim has not been considered because the International Searching Authority does not have in its possession a copy of the earlier application whose priority has been claimed or, where required, a translation of that earlier application. This opinion has nevertheless been established on the assumption that the relevant date (Rules 43bis.1 and 64.1) is the claimed priority date.
2.  This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43bis.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.
3. Additional observations, if necessary:

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.  
PCT/GB2005/005058

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**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or  
industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

|                               |             |                                 |
|-------------------------------|-------------|---------------------------------|
| Novelty (N)                   | Yes: Claims | 27,36,37,40,41,43,44,50-52      |
|                               | No: Claims  | 1-26,28-35,38,39,42,45-49,53-58 |
| Inventive step (IS)           | Yes: Claims | -                               |
|                               | No: Claims  | 1-58                            |
| Industrial applicability (IA) | Yes: Claims | 1-58                            |
|                               | No: Claims  | -                               |

**2. Citations and explanations**

**see separate sheet**

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**Box No. VI Certain documents cited**

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**1. Certain published documents (Rules 43bis.1 and 70.10)**

and / or

**2. Non-written disclosures (Rules 43bis.1 and 70.9)**

**see form 210**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING  
AUTHORITY (SEPARATE SHEET)**

International application No.

PCT/GB2005/005058

**Re Item V.**

1. Reference is made to the following documents:
  - D1 : DATABASE WPI Section Ch, Week 198632 Derwent Publications Ltd., London, GB; Class A26, AN 1986-208862 &; JP 61 141725 A (AGENCY OF IND SCI & TECHNOLOGY) 28 June 1986 (1986-06-28)
  - D2 : HAMEURLAINE A ET AL: "Synthesis of soluble oligocarbazole derivatives" TETRAHEDRON LETTERS, ELSEVIER, AMSTERDAM, NL, vol. 44, no. 5, 27 January 2003 (2003-01-27), pages 957-959, XP004408875 ISSN: 0040-4039
  - D3 : JOVANOVIC M V ET AL: "Bromination of 10-phenylphenothiazine and 10-phenylphenoxazine" JOURNAL OF ORGANIC CHEMISTRY, AMERICAN CHEMICAL SOCIETY, EASTON, US, vol. 49, 1984, pages 1905-1908, XP002275206 ISSN: 0022-3263
  - D4 : ZHANG,Q. ET AL.: "Novel hole-transporting materials based on 1,4-bis(carbazolyl)benzene for organic light-emitting devices" JOURNAL OF MATERIALS CHEMISTRY, vol. 14, no. 5, 20 January 2004 (2004-01-20), pages 895-900, XP002373568
  - D5 : a) PATENT ABSTRACTS OF JAPAN vol. 2003, no. 11, 5 November 2003 (2003-11-05) -& b) JP 2003 212850 A (JAPAN SCIENCE & TECHNOLOGY CORP), 30 July 2003 (2003-07-30)
  - D6 : WO 03/074628 A (CDT OXFORD LIMITED; ANDREWS, MARK, DAVID; LOOK, KAI; MOSLEY, ALAN; STE) 12 September 2003 (2003-09-12)
  - D7 : HELIWINKEL,D.; SCHMIDT,W.: "Zweifach ortho-verbrückte Triphenylamin-Derivate" CHEMISCHE BERICHTE, vol. 113, 1980, pages 358-384, XP009063905
  - D8 : PATENT ABSTRACTS OF JAPAN vol. 2003, no. 12, 5 December 2003 (2003-12-05) & JP 2005 071909 A (DAINIPPON PRINTING CO LTD), 17 March 2005 (2005-03-17)

**2. INDEPENDENT CLAIMS 1, 8, 14, AND 29**

- 2.1 The present application does not meet the criteria of Article 33(1) PCT, because the

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING  
AUTHORITY (SEPARATE SHEET)**

International application No.

PCT/GB2005/005058

subject-matter of claim 1 is not new in the sense of Article 33(2) PCT. Each of the documents D1 (D1 abstract), D2 (compounds 7c and 7d displayed in figure 1), D3 (e.g. compound 19 shown on page 1907), D4 (e.g. compound 8 in scheme 2), and D5 (compounds of table 1 in paragraph 0028) anticipate compounds which fall within the scope of independent claim 1 of the present application. The subject-matter of independent claim 8 is revealed in scheme 1 of D4 and in e.g. the reaction scheme shown on page 12 of D6. Compounds according to independent claim 14 of the present application are described in D7 (see for instance table on page 354 of D7).

Polymers which anticipate the subject-matter of independent claim 29 are disclosed in D1 (abstract), D2 (compound 13 in figure 3), and D5 (abstract).

Thus, the subject-matter of independent claims 1,8,14, and 29 of the present application does not meet the requirements of Art. 33(2) and (3) PCT in view of D1-D7.

The subject-matter of independent claims 1,8,14, and 29 meets the requirements of Art. 33(4) PCT.

3. **DEPENDENT CLAIMS** 2-7, 9-13, 15-28, and 30-58 do in their present form not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).

The subject-matter of dependent claims 2-7, 9-13, 15-28, and 30-58 meets the requirements of Art. 33(4) PCT.

**Re item VI.**

4. Document D8, published on 17.03.2005, claims the priority date 27.08.2003. D8 discloses poly(biscarbazole aryls) (see D8, abstract). Hence, the document may be relevant as to the question of novelty when entering the national/regional phase.

**Re Item VIII.**

**5. Clarity of the claims (Art. 6 PCT)**

- 5.1 Claim 8: claim 8 refers to the preceding claims. However, claim 8 is regarded as an independent claim, since the structure (5) differs from the structure (2) of claim 1.
- 5.2 Claim 14: the considerations of item 4.1 also apply to the subject-matter of claim 14. Formula (9) of claim 14 is different from the formula (2) of claim 1.
- 5.3 Claim 13: claim 10 does not mention a substituent R.
- 5.4 Claim 20: a carbon atom cannot be a heteroatom.
- 5.5 Claim 24: the subject-matter appears to be redundant in the light of claim 1.
- 5.6 Claim 29: the wording of the claim suggests that homopolymers are claimed. However, it is clear from e.g. claim 30 that the scope of claim 29 also includes copolymers. Thus, the subject-matter of claim 29 is unclear.
- 5.7 Claim 58: The claim has been designated 'claim 59' in the application as originally filed. A correction under Rule 26 PCT received 30.01.2006 rectifies this obvious error.
- 5.8 Claim 29: it appears that the following feature is essential to the definition of the invention (see e.g. last paragraph on page 25, and formulae (11)-(14) on pages 10 and 11 of the present application): when monomers according to formula (2) of claim 1 of the application are used for preparing the polymers, the moiety Ar<sub>3</sub> appears to be necessarily incorporated into the main chain of the polymer, thus increasing the rigidity of the central amine of the monomeric units. However, there is no clear restriction in present claim 29 that the monomers according to formula (2) of claim 1 are incorporated in such a way that groups Ar<sub>1</sub> and Ar<sub>3</sub> form part of the polymer backbone/main chain. Thus, the subject-matter of claim 29 is unclear.